

TABLE 2.—Summary of the types of vertebral anomalies in *Synphobranchus affinis* eelvers expressed as percent of specimens with anomalies. The sum of the percentages is greater than 100% because some individuals had more than one type.

Item	Eelvers	Larger immature fish
Sample size	29	24
Abnormal hemal spines	81.6	83.3
Abnormal neural spines	3.4	0.0
Fused or partially fused vertebrae	13.6	16.7
Multiple anomalies	57.8	16.7

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#### CATCHES OF ALBACORE AT DIFFERENT TIMES OF THE DAY

The purpose of this study is to examine the hypothesis that diel variations occur in the catches of albacore by boats trolling surface jigs off Oregon. Although albacore fishermen talk of "morning bites" and "evening bites," no published data exist, to our knowledge, confirming these trends.

Studies on the feeding habits of tunas, however, provide evidence for intense feeding activity during certain periods of the day. Based on the quantity of food in stomachs, Iverson (1962) concluded that major feeding periods of albacore occurred in early morning and late afternoon-evening. Similarly, Nakamura (1965) and Dragovich (1970) found evidence for morning and late afternoon peaks in the stomach fullness of skipjack and yellowfin tunas. Food consumption of captive skipjack was greatest between 0630 and 0830 h, and skipjack tuna in only one of three tanks fed intensively in late afternoon (Magnuson 1969). This was in agreement with Uda (1940) who reported that catches of skipjack tuna with pole and live bait peaked in early morning hours and were usually followed by successively lower peaks later in the day.

Fishermen were solicited to record data on 1969 and 1970 albacore catches in special logbooks. Several entries per day were requested. The records of five boats fishing off Oregon during July, August, and September 1969 were used for this study. These five skippers kept detailed records averaging eight entries per day. In 1970 the records of 12 boats were used that recorded catches at least every 4 h during the fishing day for 20 July-2 August 1970. All boats were 45-60 feet in length.

Average catches per boat were calculated for each hour fished, usually 0500-2200 h or 2300 PDT, for 3 mo in 1969 and 2 wk in 1970. When the interval between logged catches was greater than 1 h, the catch for the interval was divided by the number of hours fished, and this average number was distributed uniformly within the interval. Because the selected boats did not necessarily fish in the same locality or during the same days of the months, the data provide only an estimate of the general trends in hourly catches of albacore off Oregon.

The catches of albacore versus hours of the day are shown in Figure 1. Chi-square tests of the

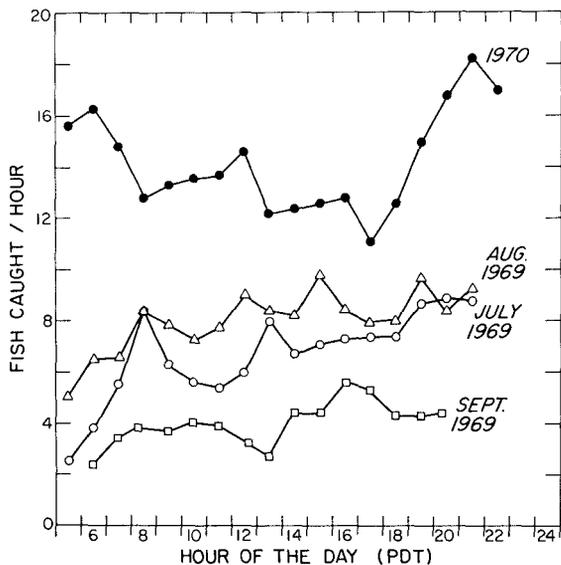


FIGURE 1.—Average catch of albacore per boat for each hour of the day from 0500 to 2200 for 3 mo in 1969 and for 20 July-2 August 1970. The numbers for hours of the day refer to the time at the beginning of the interval.

heterogeneity of catches for all four of the data sets are significant ( $P < 0.05$ ), indicating that catch rates were not constant with time but varied throughout the day. Consistent trends for diel periodicity in catches, however, are not apparent.

Only during 1970 was there an obvious trend for peak catch rates to occur early in the morning and in the evening. These peaks coincided with the local mean times of sunrise and sunset (about 0600 and 2100 PDT).

The separate months of 1969 show a variable pattern with peaks occurring at different times during different months. There is no evidence for a pronounced early morning "bite," except perhaps 0800-0900 in July. Catch rates generally increased with time during the day. Most 1969 afternoon catch rates were above the median for each of the 3 mo, but they were not markedly higher in the evening as was found for 1970.

The catches during 1970 were exceptionally high. Even the lowest 1970 catch rate was higher than any of the peak 1969 catches (Figure 1). The 1970 jig-boat season for albacore off Oregon was unusually short (most fish were caught between 22 and 29 July) and the fleet was localized in a small area (Pearcy 1973; Keene 1974). For those reasons, the spatiotemporal variability for the 1970 data is probably much less than for the separate months of 1969.

From our limited data we conclude that albacore feed throughout the day. Catch rates averaged over several weeks do not always indicate morning and evening periods of intense feeding. Obviously this does not preclude the occurrence of morning and/or evening bites in some areas on some days.

Although stomach fullness and catch rates are both related to feeding behavior, they may provide different results on feeding periodicity because of the influence of such factors as changes in depth distributions, vulnerability to fishing methods, and the times required for accumulation and digestion of food in the fish's stomach. For example, the especially high rates of capture of albacore on surface jigs during sunrise-sunset periods of 1970 may be related to the vertical migration of Pacific saury, *Cololabis saira*, their major prey during this time (Pearcy 1973). Saury migrate to surface waters at sunset and descend into deeper waters at sunrise (Hotta and Odate 1956; Hughes and Gill 1970). Relatively low catch rates during the day may therefore be the result of either albacore pursuing saury into deeper water where albacore are less vulnerable to surface lures or to reduced feeding activity.

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